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How is the Students' Sustainability Literacy of Junior High Schools in West Java?

Indarini Dwi Pursitasari [1]*, Anna Permanasari[1], Bibin Rubini[1], Mohamad Iqbal Suriansyah[2], Annisa Nurramadhani[3], Toru Matsumoto[4], Indriyani Rachman[1]

[1] *Department of Science Education, Universitas Pakuan, Indonesia*
[2] *Department of Computer, Universitas Pakuan, Indonesia*
[3] *Department of PGSD, Universitas Pakuan, Indonesia*
[4] *Department of Environmental Systems, The University of Kitakyushu, Japan*

**Correspondence Author: indarini.dp@unpak.ac.id*

ABSTRACT
This research aims to investigate junior high school students' sustainability literacy in science learning at environmentally based schools and non-environmentally based schools. This research is quantitative and uses a survey method. The participants are 902 students from three non-environmentally oriented school-based junior high schools and three environmentally oriented school-based junior high schools in West Java. Research data were gathered via a survey questionnaire comprising 25 closed-ended statements and 2 open-ended questions, both of which were valid and reliable. Data analysis of closed statements using the RASCH model by categorizing sustainability literacy using a logit value person (LVP) design. The data analysis of open-ended questions uses Voyant Tools, a website that can digitally read and analyze text. The results showed that students' sustainability literacy in both types of schools was moderate, with averages of 77.2 and 76.9. The highest scoring aspect is awareness of environmentally friendly practices. In contrast, the lowest aspect is waste management habits, and the aspect that students in environmentally school-based settings have, with lower levels than in non-environmentally school-based settings, is environmental action and advocacy for sustainable practices. This research highlighted that junior high school students' sustainability literacy profiles are still in the moderate category across both school categories and need improvement.

Keywords: *sustainability literacy; junior high school; environmentally based school; sains learning*

INTRODUCTION

The escalating global concerns about climate change, biodiversity decline, and resource depletion have heightened the importance of sustainability literacy as an essential educational objective (Akinsemolu & Onyeaka, 2025; Kazazoglu, 2025; Shang et al., 2024). Sustainability literacy encompasses the information, skills, attitudes, and behaviours that empower individuals to make informed decisions and undertake responsible activities regarding environmental stewardship, social equality, and economic resilience (Chinedu et al., 2023; Colucci-Gray et al., 2006; Qureshi, 2020). Warren et al., (2014) identify four key components of sustainability literacy: future thinking, values thinking, systems thinking, and strategic thinking. Future thinking encompasses the capacity to analyze, assess, and formulate a comprehensive vision for sustainable development, pertinent to sustainability challenges and problem-solving methodologies. Values thinking is an approach that emphasizes values, cognitive orientation, and ethical reasoning.

Systems thinking, or holistic thinking, refers to the capacity to analyze intricate systems across society, the environment, and the economy at local and global levels. Strategic thinking entails formulating a strategy or plan to realize a particular vision.

In the past ten years, many studies have looked at how well students understand ideas about sustainability. These studies mainly focus on colleges and universities or compare different countries (Aikowe & Mazancova, 2023; Ariyatun et al., 2024; Décamps et al., 2017; Fatimah et al., 2025; Fošner, 2025; Ling et al., 2021; Winter & Cotton, 2012). Recent research highlights the importance of understanding sustainability, but it shows that students lack a basic grasp of the concept.

Notwithstanding this worldwide impetus, empirical research on students' sustainability literacy is scarce in numerous locations, including Indonesia. Most research in Indonesia looks at environmental awareness or scientific understanding. It does not focus on a complete view that includes environmental, social, and economic aspects of sustainability (Ariyatun et al., 2024; Husamah et al., 2025; Perea et al., 2025; Permana et al., 2023; Prayogo et al., 2024; Rahmasary et al., 2020; Wardhani et al., 2024). Rapid urban growth, damage to the environment, and social inequalities present serious sustainability challenges for Indonesia. However, we know little about how students, who will be future decision-makers, understand and relate to these issues (Arifin et al., 2024; Parker & Prabawa-Sear, 2020; Yodha, 2018).The lack of this evidence obstructs the development of curriculum and policies that successfully foster sustainability competencies in students.

Fostering sustainable literacy at an early age is crucial, as it enables children to understand their connection to the environment and the global community. It aligns with Redman (2013) assertion regarding the significance of including sustainability education in primary and secondary school curricula. Habits established in early childhood evolve into enduring behaviours and thought patterns that persist throughout adulthood, so forming a robust foundation (Gardner & Rebar, 2019; Nurdiana, 2021). Students can serve as proactive catalysts for fostering a sustainable future. The Indonesian government promotes environmental education in schools to cultivate students' and youth's knowledge of sustainability. Environmental education is crucial, as are the eco-friendly educational programs established by environmental schools in each region, serving as models for implementing ESD-based initiatives (Lace-Jeruma & Birzina, 2019; Nurwidodo et al., 2020). These initiatives are conducted as competitions to incentivize stakeholders, students, educators, and school administrators to enhance environmental awareness.

An individual possessing sustainability literacy is not only informed about global challenges such as pollution and climate change but is also capable of engaging in behaviours and making decisions that promote sustainability, including minimizing waste, selecting environmentally friendly products, participating in community initiatives, and advocating for equitable and environmentally conscious policies (Leiva-Brondo et al., 2022; Nurramadhani et al., 2024; Putri et al., 2023). Sustainability literacy serves as a crucial basis for cultivating global citizens who are compassionate, adaptive, and equipped to confront future environmental and social concerns. Accelerated environmental and social transformations pose a worldwide challenge to sustainable development. This underscores the necessity of imparting sustainability literacy to students. Comprehending global challenges, including poverty, migration, globalization, and climate change, is crucial for cultivating sustainability literacy (Davies, 2006).

Students' perceptions of their comprehension of sustainability literacy have yet to be examined. Students' perspectives of sustainability literacy can inform enhancements to the curriculum and environmental education through science instruction in Indonesia. This research aims to ascertain students' perceptions of sustainability literacy, specifically in junior high schools, within the context of environmental learning integrated with science education in both environmentally school-based and non-environmentally school-based settings. The novelty of this

research lies in its attempt to uncover perceptions of sustainability literacy among junior high school students in environmentally school-based settings, which have long been claimed to foster environmentally friendly behaviour in the context of junior high school students' sustainability literacy, by directly comparing them with non-environmentally based schools.

METHODOLOGY

Research Design

This study employs quantitative research by survey to examine sustainability literacy and awareness among junior high school students in West Java

Participant

The participants in this study comprised three schools that do not emphasize environmental education and three schools that incorporate an environmentally focused curriculum. The determination of the six schools is based on the curriculum used in the education unit. The curriculum of an environmentally based school comprises four primary components: (1) Environmentally Conscious Policies; (2) Implementation of an Eco-centric Curriculum; (3) Participatory Eco-friendly Activities; and 4) Management of Sustainable Supporting Facilities. The non-environmental school-based uses the national curriculum. Participants were selected using a cluster purposive sampling method. The total number of students included in this study is 902, as presented in Table 1.

Table 1. The Demographics of The Research Subject

The schools	Boys	Girls	Total
Environmentally School-based	210	242	452
Non-Environmentally School-based	178	272	450

Samples were conducted by purposive sampling. Purposive sampling is used to select the sample based on the research's criteria and requirements. In this study, the sample used was junior high school students from both green and non-green schools, including public and private institutions. The school is located in an urban area near the capital of Indonesia and is a model for the green school program.

Instrument

Research data were gathered via a survey questionnaire comprising 25 closed statements (Murray & Cotgrave, 2007) and two open-ended questions. The sustainability literacy questionnaire encompasses knowledge, attitudes, and behavioural dimensions (Chen et al., 2022) and comprises five aspects: (1) Awareness of environmentally friendly practices; (2) Waste management habits; (3) Comprehension of environmental concepts; (4) Engagement in environmental actions; and (5) Advocacy for sustainable behaviour. Each indicator consists of 5 statements. The Likert scale from 1 to 4 with a statement of agreement with the criteria as follows: strongly disagree = 1, disagree = 2, agree = 3, and strongly agree = 4.

Before going into detail on the findings regarding the sustainability literacy of junior high school students, Validity and reliability tests are conducted using Rasch models. According to Andrich & Marais (2019), Bond & Fox (2015), and Wright & Linacre (1994), the criteria are as follows: (1) The Infit-Outfit mean square (MNSQ) value is either at 1, which is considered to be the ideal value, or within the range of 0.5 to 1.5 to see the fit and valid items and there are variations in the answers, (2) Ideally, the Infit-outfit Z-standard (ZSTD) value should be at zero, although it is acceptable as long as it falls within the range of -2 to 2, this threshold can be ignored if the samples are more than 200 (Azizan et al., 2020) to show valid and consistent items, and (3) Point

Measure Correlation (Pt Mean Corr) the value should between 0,4-0,85 to show how well the item distinguishes the respondents' abilities. Reliability Item should be more than 0.6. As shown in Table 2, the results indicate that the MNSQ, ZSTD, and dependability values all meet the standards. Therefore, it is possible to proceed with the assessment of the sustainability literacy perspectives of junior high school students attending both environmentally based and non-environmentally based schools.

Table 2. The Validity and Reliability Test of Sustainability Literacy Instruments

Criteria	Score
MNSQ (Infit) Item	0.99
ZSTD (Infit) Item	-1.14
MNSQ (Outfit) Item	1.01
ZSTD (Outfit) Item	-0.93
Pt Mean Corr	0.52
Reliability Item	1.00

Based on these results, it was concluded that each questionnaire item is valid and reliable. The sustainability literacy questionnaire instrument can reliably measure the extent to which students understand this. The items in these instruments consist of measures designed to assess respondents' abilities. Similarly, this is evident in the students' valid and reliable responses. It proves that the students completed the questionnaire seriously and truthfully, reflecting their actual circumstances.

Data Analysis

In this research, the RASCH model was also applied to analyze the data. After ordinal data are collected, they are transformed into interval data. It is to ensure that the values for each sustainability literacy indicator across all subjects and schools are within the same range. The RASCH model requires a prerequisite analysis before the data are calculated and analyzed to estimate the logit value per person (LVP) and discover students' sustainability literacy levels. The prerequisite test indicated that the LVP analysis could proceed. Because the criteria for MNSQ Person infit/outfit values, ZSTD Person infit/outfit values, and person reliability are met as shown in Table 3.

Table 3. The Prerequisite Test of Students' Sustainability Literacy

Criteria	Score
MNSQ (Infit) Person	1.05
ZSTD (Infit) Person	-0.11
MNSQ (Outfit) Person	1.01
ZSTD (Outfit) Person	-0.22
Person Reliability	0.82

Once it is confirmed that the prerequisites are met, students' sustainability literacy levels can be categorized using LVP. LVP analysis is a part of the RASCH Model analysis for categorizing a person's ability. It can be determined in detail which parts have a high logit value (above 0), indicating that the students' skills in that aspect or overall are good. Furthermore, which parts have a low logit value (below 0), indicating that students' abilities in those aspects or overall are not strong or still need improvement? Because the items on sustainability literacy are questionnaires, the evaluation results are polytomous. The results are then categorized according to Table 4. The division of the assessment boundaries is explained by a logit-valued person with a sustainability literacy score (SD = -0.91, Mean =- 1.55).

Table 4. Categorization of Student Sustainability Literacy

Students' Sustainability Literacy Scores (X)	Category
X < Mean – SD	Low
Mean – SD < X < Mean + SD	Moderate
X > Mean + SD	High

The analysis of student sustainability literacy data, per aspect, was carried out using a Likert scale of 1–4 and was conducted in a quantitative descriptive manner. The calculation formula used is:

$$\text{Score} = \frac{\text{student score}}{\text{maximum score}} \text{ x } 100 \quad (1)$$

Analysis of the open-ended questionnaire as supporting data, which is done by calculating the frequency of words that appear in the students' answers. The analysis steps taken are as follows: determining the data source from the students' answers, which consist of two open-ended questions. The text unit being counted is words. Cleaning word data using stop words. It aims to remove common words such as and, the, for, in, and so on. Then, calculate the word frequency. The analysis tool used to calculate word frequency is Voyant Tools. a website that can digitally read and analyze text. Word frequency is viewed in terms of cirrus and terms. The results were presented as a word cloud. After the results are obtained, they are interpreted to reveal patterns and the focus of students' answers. In the end, conclusions are drawn from the analysis conducted.

RESULT AND DISCUSSION

Students' Sustainability Literacy Profiles

The general profiling findings of junior high school students' literacy in sustainability reveal that the results are quite similar in both green and non-green schools. The majority of schools, both environmentally based and non-environmentally based, fall into the moderate category of sustainability literacy, as determined by the logit value person evaluation. Schools that have received the environmentally based schools award have the highest number of students who are literate in sustainability in the high category (Table 5). On the other hand, it is apparent that, compared to non-green schools, the percentage of students in green schools with low sustainability literacy is rather high.

Table 5. General Results of Students' Sustainability Literacy

School Category	N	Count			Percentage (%)			Logit average
		Low	Moderate	High	Low	Moderate	High	
Environmentally based schools	453	59	323	71	13	71	16	1.6
Non-environmentally-based schools	451	42	346	63	9	77	14	1.5

When it comes to students' sustainability literacy profiles in junior high school, the majority fall into the moderate category, regardless of whether they attend an environmentally focused school or a non-environmentally focused school. The comparison of sustainability literacy scores for students in environmentally based and non-environmentally based schools is presented in Table 6.

Table 6. Descriptive of Student Sustainability Literacy

No.	Description	Environmentally based schools	Non-environmental-based schools
1.	Number of students	453	451
2.	Highest score	98	94
3.	Lowest score	60	59
4.	Average score	77.2	76.9
5.	Standard deviation	7.04	6.50

Table 5 shows that students in environmentally based schools have slightly higher sustainability literacy than those in non-environmentally based schools. The same tendency occurs in the lowest and highest scores. It is because students in non-environmental schools also receive

environmental education. In addition, the school has also implemented the importance of protecting the surrounding environment.

Further analysis of sustainability literacy data aims to determine students' acquisition of sustainability literacy in each aspect (Figure 1). The figure shows that students' comprehension of environmental concepts, waste management habits, and awareness of environmentally friendly practices are higher in environmentally based schools than in non-environmentally based schools. It is because, at environmentally based schools, there is an environmental rescue and sustainable development program to help school residents who care about and uphold an environmental culture grounded in the norms of togetherness, openness, honesty, justice, and the sustainability of the environment and natural resources. The outcomes of engagement in environmental action and advocacy for sustainable practices are distinctive. Students in environmentally based schools, presumed to have superior perceptions compared to their counterparts in non-green schools, unexpectedly exhibited the opposite outcomes.

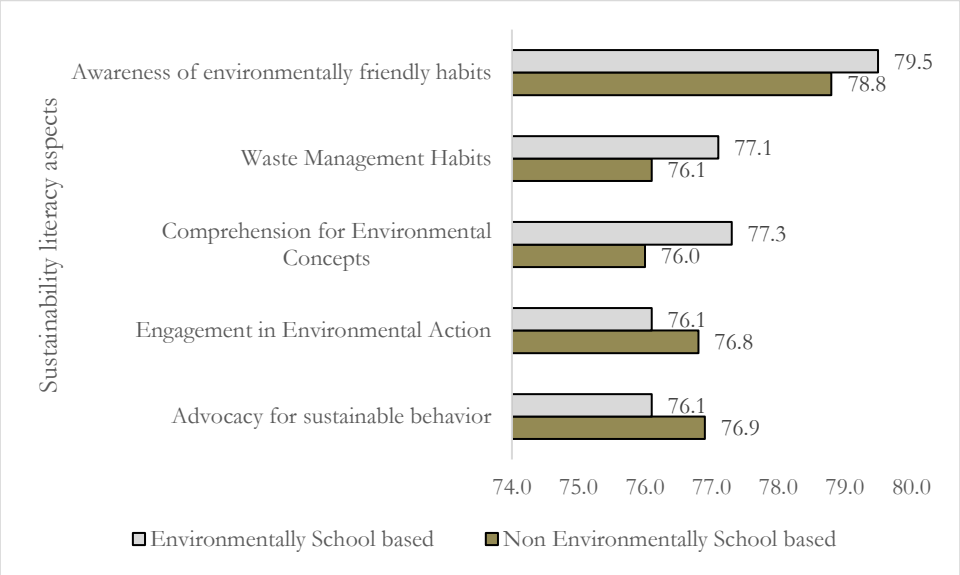

Figure 1. Result of Students' Sustainability Literacy in Each Aspect

Words Analysis from Students Sustainability Literacy

The results on students' sustainability literacy in both schools are classified as moderate, as supported by the open questionnaire given to students in both classes. The results demonstrate that students in both environmentally based and non-environmentally based schools associate sustainability and environmental education with trash management and flooding. Comprehension of waste encompasses plastic waste and the process of recycling. There is a lack of student awareness concerning carbon emissions, energy usage, biodiversity, and sustainable practices. The environmental perspective encompasses not only plastic waste and recycling but also daily practices related to energy conservation, dietary choices, and the use of electronic devices, among others.

It is strengthened by the results from Figure 2, which elaborate on students' written responses regarding sustainability literacy from both green and non-green schools. The emergence of terms like community, support, and infrastructure also indicates that students recognize the importance of support from their surroundings and broader institutions in achieving sustainable behavior. Although students already understand the importance of a sustainable lifestyle, its application in daily life is still influenced by factors such as cost, availability of facilities, and inconsistent personal habits.

Figure 2. Word Analysis of The Students from The Environmentally Based Schools' Answer to Sustainability Literacy

The analysis results show that students already have a strong ecological awareness, especially in terms of waste management. Students are heavily involved in activities focused on sorting, reducing, and recycling waste, both at school and at home. Educational institutions serve as key avenues for fostering sustainable habits through diverse environmental initiatives and activities; however, comparable practices are also emerging in students' homes. The actions students take are generally practical and context-specific, such as planting trees, saving water, or turning off lights. Nevertheless, they do not completely cover wider aspects such as policy, infrastructure, and institutional backing. Moreover, there is evidence of social and collective consciousness among students regarding environmental protection, evident in their collaboration, mutual support, and active involvement in school initiatives aimed at sustainability.

Students already have a high awareness of the importance of sustainable living, especially students in green schools. However, students' behavioral changes are still hindered by factors such as habit, laziness, and a lack of discipline in consistently implementing environmentally friendly actions. Additionally, efforts to adopt a sustainable lifestyle are also influenced by economic limitations and the lack of adequate supporting facilities in the surrounding environment.

Discussion

The comparison of sustainability literacy among students in environmentally based schools and non-environmentally based schools indicates quite similar results. Although both school categories have moderate environmental literacy, students in environmentally based schools achieve higher scores than in non-environmentally based schools. A variety of elements can be used to explain the findings, indicating that there is no substantial difference, but that environmentally based schools have a modest edge over other schools. To begin, the standardization of curricula and the distribution of Education for Sustainable Development resources have ensured that a significant number of schools that are not part of the environmentally based schools program continue to impart sustainability concepts to students through formal academic subjects and creative teacher-led projects. The research results align with the finding that the eco-school program is not a superior environmental teaching technique compared to other approaches implemented in conventional schools (Spínola, 2015). Hence, it has led to relatively similar sustainability literacy profiling scores across students in both schools' categories in this research.

Furthermore, it yields a similar result to Simel (2013), who elaborates that although the results were slightly better for environmentally based schools, they failed to promote environmental behaviour. Secondly, the implementation of environmentally based schools is frequently

inconsistent. Some educational institutions place greater emphasis on administrative aspects and certification documentation than on changing daily teaching practices (Spínola, 2015). As a result, the actual impact on student literacy is not as significant as one might anticipate, even though there is a positive trend in green school scores.

While students' environmentally based schools achieved marginally superior scores, suggesting a favourable impact of the environmentally based schools' curriculum, the differences are not substantial enough to yield consistently meaningful variations across all literacy parameters. Research indicated that disparities in knowledge and attitudes existed between environmentally based schools and non-environmentally based schools, although no variations were observed in abilities related to environmental harm prevention (Rahmadiani et al., 2022). Nurwaqidah et al. (2019) discovered that while a positive correlation existed between green schools' level and environmental literacy scores, the majority of students in both cohorts fell short of the anticipated environmental literacy standard, suggesting that, despite a marginal advantage for green schools students, the overall literacy status required enhancement in both groups, particularly in sustainability literacy.

Actually, an individual's interest in and attitude towards environmental issues are not exclusively determined by their educational institution's designation. Not all environmentally focused schools effectively implement sustainability principles. It is proven that they lack sustainability literacy, focusing only on the environmental aspect. It should discuss pertinent carbon emissions, energy use, biodiversity, social practices, and sustainable practices. The environmental perspective encompasses not only plastic waste and recycling but also daily practices related to energy conservation, dietary choices, and the use of electronic devices, among others. At times, the program prioritizes administrative tasks, such as accreditation documentation, over transforming the school's culture. Incorporating environmental materials into courses may be superficial, thereby limiting their impact on students' sustainability literacy. Thus, it renders the green school's program less effective, resulting in a student profile of sustainability literacy that is not markedly different from that of students in non-green schools. However, this contradicts some research, which states that environmentally based schools execute initiatives that promote environmental stewardship, potentially enhancing student involvement and academic performance (Boeve-de Pauw & Van Petegem, 2018; Goldman et al., 2018; Tanubrata et al., 2024).

Details of junior high school students' sustainability literacy can be found in the results for each aspect. One aspect that has the highest value among others is awareness of environmentally friendly practices in both environmentally based and non-environmentally based schools. It could be because students in both schools are already frequently exposed to environmental issues and problems, both in their learning and in their surrounding communities. Environmental issues are a major global concern and the primary focus for maintaining sustainability. Therefore, the entire global community will compete to find the best solutions to sustain the environment and ensure continuity. According to several studies, environmental sustainability has emerged as a pivotal concern that integrates with everyday life, shaping individual decisions and communal actions (Lim et al., 2025; Roseland, 2000). Incorporating ecological concepts into daily activities enhances personal well-being and cultivates a shared responsibility for the environment. This synthesis emphasizes essential elements of integrating sustainability into everyday life.

Besides the highest score on students' sustainability literacy, there is also the lowest score on the waste management habits aspect. Habits are something that needs to be consistently practiced over a long period of time. Habits are also not the result of instant activities. Students are asked to understand and internalize sustainability so that their sustainability literacy is well-developed. Habits are indeed distinct from attitudes, requiring a structured process for their formation (Gardner & Rebar, 2019; Nurdiana, 2021). The development of habits involves repeated actions that become automatic over time, often necessitating a significant investment of time and effort to establish. Various factors, including motivation, attitudes, and self-regulatory strategies,

influence this process. Research indicates that forming habits can take considerable time, with the duration varying based on individual circumstances and the complexity of the behavior (Singh et al., 2024).

Students' waste management habits are often poor due to a combination of factors. Many students have a limited understanding of waste management principles, with studies showing that a significant percentage lack knowledge of waste classification. In line with research findings that approximately 70% of kids and students are unaware of the circular economy, the waste hierarchy, prevention, separate collection, and waste separation (Harman & Yenikalayci, 2022; Virsta et al., 2020). The average student generates substantial waste, often discarding items rather than sorting them, reflecting a culture of disposability (Zhang, 2023). Despite a general interest in participating in awareness programs, the lack of structured initiatives limits students' engagement in sustainable practices (Alazaiza et al., 2025). It is contradictory to the research. Individuals can adopt sustainable practices by recycling, supporting local businesses, and practicing responsible consumerism, which collectively contribute to a sustainable society (Salonen & Åhlberg, 2011).

Another aspect is that engagement in environmental action and advocacy for sustainable practices yields distinct results. These two aspects indicate that students in green schools have lower levels of sustainability literacy than those in non-green schools. Many factors influence the results of this sustainability literacy profiling. Students may receive sustainability education from home, community organizations, religious activities, or local communities active in environmental issues. Additionally, widespread access to the internet, social media, and educational programs can provide knowledge and awareness of sustainability comparable to that gained through formal learning. The Indonesian curriculum already includes environmental and sustainability materials integrated across various subjects. It allows creative teachers in non-green schools to offer learning experiences similar to those found in green schools. Environmentalist teachers in non-green schools may develop comparable project-based learning, practical work, or field activities, so that students' learning experiences related to sustainability in non- green schools can be well-developed.

This small difference implies that to achieve real excellence, green schools need to emphasize the quality and consistency of program implementation, not just status or labels. Aspects such as teacher involvement in environmental project-based learning, environmental behavior evaluation practices, and the integration of affective aspects and real actions (everyday habits) need to be strengthened. Research by Astuti & Aminatun (2020) shows that both the environmental competence and disposition domains are better in environmentally based schools than in non-environmentally based schools, but remain considered good (not excellent), indicating room for improvement in all schools.

The finding that junior high school students' sustainability literacy remains at a moderate level indicates that, although there is already an understanding of sustainability issues, important aspects such as practical application, pro-environmental behavior, and cognitive depth are not yet fully optimal. It implies that schools need to strengthen experiential and contextual learning, which allows students to be directly involved in real actions to protect the surrounding environment. For example, research by Paryanti et al. (2021) and Kadarisman et al. (2023) showed that the average sustainability literacy of junior high school students on the theme of environmental pollution was only around 50%, with the indicators "follow-up on environmental issues" and "personal response to environmental problems" scoring lower than the knowledge indicator. Hence, it means that education policies and practices need to not only convey theory, but also encourage the development of students' attitudes and actions, for example, through school environmental projects, school-community cooperation, and behavior-based assessment to increase sustainability literacy from moderate to high levels.

The novelty of this study lies in its attempt to uncover perceptions of sustainability literacy among junior high school students in environmentally school-based settings, which have long been

claimed to foster environmentally friendly behaviour in the context of junior high school students' sustainability literacy, by directly comparing them with non-environmentally based schools.

Limitations and recommendations for future study

This study is limited by its restricted geographical reach and cross-sectional design, which inhibit the portrayal of longitudinal literacy growth and the identification of causal linkages. Furthermore, the measurement instruments focus on cognitive and attitudinal aspects, potentially resulting in an underrepresentation of students' actual behaviours. Future research should involve a broader, more diverse sample, employ mixed-methods to examine contextual factors affecting sustainability literacy, and include long-term behavioural assessments and interventions to evaluate the efficacy of environmental education programs and policies thoroughly.

CONCLUSION

The sustainability literacy profile of junior high school students in both environmentally based and non-environmentally based schools is categorized as moderate, indicating that their comprehension of sustainability concepts, attitudes, and skills has advanced but has not yet reached the anticipated high standard. While student scores at environmentally based schools were marginally superior, the disparity was not substantial, suggesting that the efficacy of sustainability literacy is influenced not solely by the school's program status but also by additional factors, including the quality of implementation, the role of educators, familial support, and exposure to information from media and community sources.

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